Comparison of Eucheuma Cottonii Seaweed Drying Methods on the Quality of Dried Seaweed in the Tanjung Area, West Nunukan District, Nunukan Regency

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Abstract. Nunukan Regency is one of the regencies in North Kalimantan Province which is one of the regencies that produces seaweed which is processed into dried seaweed. To handle seaweed products, a drying method is needed that is suitable and easy for the community to use and it is necessary to know what methods of drying seaweed are and the impact of drying on the quality of the community. Based on the results of research observations conducted, there are 4 types of drying methods used, namely the base drying method, hanging drying method, para-para drying method and Dome Dryer drying method. Of the 4 drying methods, the gantug drying method is the drying method that has good drying results because the drying process does not involve cutting the base/stem of the seaweed, although this method is less popular with the local community and they prefer the para-para drying method which is deemed more effective by the public.

Keywords: Comparison, drying, seaweed.

1 Introduction

Indonesia has fairly extensive marine waters with a coastline of 81,290 kilometers. The waters, which are rich in minerals and sunlight, are fertile ground for the growth of seaweed. Seaweed is one of the superior commodities of the Indonesian government. Through the Ministry of Maritime Affairs and Fisheries (KKP) policy, the development of seaweed cultivation synergistically and simultaneously from upstream to downstream is part of the vision and mission of developing the Working Cabinet to encourage the sea as a source of the nation's economy in the future.

One of the seaweed commodity producers in North Kalimantan Province that has great potential in efforts to develop seaweed commodities is Nunukan Regency, which is one of the districts producing seaweed of the Euchima Cottoni type. North Kalimantan Province has a coastline length of 304.87 km2 and an island beach area of 26,393 ha2 with seaweed production of approximately 3000 tons per month in the form of dried seaweed products (raw material).

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The process of processing seaweed from the cultivation results is then dried traditionally by drying it in the sun. Some of the drying methods used are the drying method on para-paras and the hanging method, however, there are also some people who use the tarpaulin drying method and also the modern drying method using a dome dryer. This drying method certainly has its advantages and disadvantages in terms of effectiveness, efficiency and economy, so that of each drying method, which drying method is suitable and suits your needs.

The aim of this research is to find out the seaweed drying methods in the Tanjung community along with the advantages and disadvantages of each method, and to find out the impact on the quality of seaweed in each method of drying seaweed.

2 Literature Reviews

2.1 Seaweed (Eucheuma Cottonii)

Seaweed or algae is a marine plant that cannot be differentiated between roots, leaves and stems, so the whole body is called thallus.

Seaweed lives at a depth of 30 – 50 cm from low tide sea level with water clarity of 5 meters and requires a substrate as a place to attach such as dead coral, mollusks, sand and mud. Photosynthesis takes place not only with the help of sunlight, but also with nutrients as food (Andriawan Nur Kasrul: 2018).

In Indonesia there are various types of seaweed that are cultivated, but there are several types of superior seaweed that have been cultivated and have potential, namely: Ulva sp, Hzypnea sp, Chondrococcus hornemannii and Eucheuma Cottonii and several other types of seaweed.

Picture 1. Eucheuma Cottonii.

Rhodophyta. E. cottonii can be differentiated from its thallus in that the thallus has cylindrical or flat branches, the branches are irregular and rough (so they are circles) because they are covered with nodules or spines to protect the gametans.

The tip is pointed or blunt and is colored purple brown or yellow green. The spines of Eucheuma cottonii irregularly cover its thallus and branches. Smooth surface, cartilaginous, green, yellow-green, gray or red. The appearance of the thallus varies from simple to complex shapes. The habitat of E. cottonii is in tidal areas, flat coral reefs, attached to hard substrates.

The centers for this type of seaweed cultivation are in Central Sulawesi, South Sulawesi, East Nusa Tenggara, Bali, East Java, Southeast Sulawesi and West Nusa Tenggara. E. cottonii is taken for its chemical content, namely carrageenan, and is used in the cosmetics, food and pharmaceutical industries.

2.2 Taxonomy Of Seaweeds (Eucheuma Cottonii)

According to Hamid Abdul (2009), the taxonomy of Eucheuma cottonii seaweed is as follows:

Kingdom : Plantie
Division : Ryhodophyta
Ordo : Gigartinales
Class : Ryhodophyceae
Family : Soliriacease
Genus : Eucheuma
Species : Eucheuma cottonii

Rhodophyceae or red algae have the following biological identity: In their reproduction they do not have a whip-haired gamete stage, their reproduction is sexual with carpogonium and spermatia, their growth is uniaxial (one cell at the tip of the thallus) and multiaxial (many cells at the tip of the thallus), the attachment device (holdfast) consists of single cells or many cells, has a phycobilin pigment consisting of phycoerethrin (red), has chromatic adaptation, that is, it has adjustments between the proportion of pigment and various lighting qualities and can give rise to various colors on the thalli such as: dark red, pink, blonde , gray, yellow and green, and the cell walls are composed of two layers, namely a hard inner layer containing lots of cellulose and an outer layer consisting of pectic substances containing agar and carrageenan.

2.3 Drying Definition

Drying is defined as the loss of water through the evaporation process, either from food in liquid or solid form, with the aim of producing products with low water content. Food drying also means deliberately transferring heat from the food so that water evaporation can occur by providing latent heat of vaporization. (Andriawan Nur Kasrul: 2018).

Drying is divided into 2 types, namely natural drying and mechanical/machine drying. Natural drying is drying that is carried out without the use of machines/tools and is only carried out traditionally, examples of natural drying are; drying under the sun (Sun Drying), salting, smoking and roasting. Mechanical/machine drying is drying using tools or machines that work mechanically as a tool to collect and distribute heat energy to raw materials, for example the mechanical/machine drying method; vacuum drying, spray drying, infrared drying (oven), drying using a Solar Dryer/Doom Dryer, Freeze Drying, Cold Drying (Chiling Drying), and Smoke Machine (Smoking Device).

2.4 Methods For Drying Seaweed

The drying methods that are always used by seaweed cultivators are divided into 3 main methods, namely; drying with a base (tarpaulin or plastic), drying with a para-para and drying with the hanging drying method. These three methods are drying methods that utilize solar heat as a heat source for drying. Apart from these three methods, there are other drying methods such as using drying tools such as drying ovens and using solar dryers.

The following is a brief definition of the method for drying seaweed:

• Drying Method with a Pedestal

The drying method with a base is a method of drying seaweed that uses a base such as tarpaulin or plastic as a drying medium and is usually done on the ground.

• Drying method with Para - Para

The drying method with para-para is a drying method carried out on a wooden pole foundation which is provided with a base in the form of a polyester net or woven bamboo with cavities. This method itself is usually used more by coastal communities whose coastal environment is muddy.

• Hanging drying method

The hanging drying method is a drying method by hanging seaweed together with ropes on wooden/bamboo poles installed horizontally. This hanging method is a drying method that is often used by seaweed farmers in East Nusa Tengara Province and is considered more effective than the two methods. other.

• Dome dryer Drying Method

The dome dryer drying method is a drying method using a dome with a closed incubator resembling a greenhouse. The difference is that the dome dryer/solar dryer is made from plastic materials such as Polycarbonate. The way this method works is by collecting solar heat energy into a closed dome so that the heat circulates inside. , during the drying process the water vapor will be released through the blower.

3 Research Methods

The method used in this research is observation, literature study and interviews.
The research procedures undertaken are as follows:

1. Conduct direct observations of cultivators in the Tanjung area, West Nunukan Village, Nunukan Regency to determine the sources to be interviewed.
2. Select sources and continue with a direct interview session with the sources who have been determined by asking questions that have been prepared by the writer.
3. Make direct observations regarding the drying methods used by local cultivators.
4. Performing field data processing.
5. Comparative analysis of the four (4) drying methods used by local farmers with reference to weaknesses and advantages in terms of effectiveness, efficiency and economics as well as their impact on seaweed quality

4 Result And Discussion

4.1 Post-Harvest Handling Process For Seaweed In The Tanjung Community, West Nunukan Subdistrict

The Post-Harvest Handling Process for Seaweed in the Tanjung Community, West Nunukan Sub-district is as follows:

• Seaweed that is ready to harvest will be taken at night by the cultivators using boats and will be lifted onto the platforms in the morning

• In the morning the seaweed is lifted onto the roof to be cleaned of dirt and debris by shaking it and sorting it to select new seeds.
• Once the seaweed is clean, the seaweed will be removed from the ris line by severing the base of the seaweed directly and spreading it flat on a para-par to be dried. In this process, if the para-para becomes full, the farmers will usually hang the seaweed on the pole foundations that have been made around the para-para, this hanging dryer itself will usually only be used for 3 days to avoid damage to the fishing line.
• If the weather is clear and not cloudy or raining, the seaweed will dry within 3 - 4 days and be ready to be packed and stored in the warehouse.

Drying Methods in the Tanjung Community, West Nunukan Subdistrict

• Drying Method of the base

Fig 2. Drying Method of the base.

The Pedestal Drying Method is used by the local community to re-dry seaweed that has been stored in the warehouse. And not used in the main drying process

.• Hanging drying method

Picture 3. Hanging Drying Method.

The hanging drying method is used by the local community to make it easier to clean seaweed and if the seaweed is full.

- Drying Method Para – para

Fig 3. Metode Pengeringan Para – para.

Para-para Drying Method, is the drying method most widely used by local people, this is due to several factors such as the muddy coastal environment.

- Dome dryer Drying Method

Fig 4. Drying Method Dome dryer

The Dome Dryer Drying Method is a KOTAKU (City Without Slums) Program which was created with the aim of increasing the dry seaweed production of local communities.

Based on the results of research conducted in the Tanjung area, West Nunukan Subdistrict, there is a combination of drying methods, namely the hanging method and the para-para method, where the hanging method is made from poles that surround and form a block of space in the middle of the para-para.

This merger occurred due to several factors such as limited space capacity, excessive seaweed harvesting, and to simplify the seaweed cleaning process. Apart from the hanging and drying method, the Tanjung people also use the tarpaulin drying method. The tarpaulin drying method is usually used by the community to re-dry seaweed that has experienced an increase in water content due to humid temperatures while it is still stored in the warehouse and is not used to dry harvested seaweed.

Apart from the drying methods mentioned above, in the Tanjung area there is a modern drying method in the form of the Dome Dryer which is a KOTAKU (City

Without Slums) program owned by the Nunukan Regency government which aims to help improve the quality of community seaweed.

4.2 Advantages And Disadvantages Of Each Seaweed Drying Method

Table 1. Advantages and disadvantages of each seaweed drying method

Methods	Advantages	Weaknesses
Drying With Pedestal	It has cheap costs, because it can use tarpaulin/plastic, cement floors as a drying base.	Easily subject to contamination by dirt such as dust.
	Can be used in small places or land according to the land capacity you have.	The level of drought is uneven.
		Cannot dry when the weather is rainy and cloudy.
Drying with Para-para	Has a large drying capacity depending on the area and length of the para - para made.	The costs involved are large.
	Easy when transferring and transporting from the boat.	The quality of seaweed decreases due to the process of cutting the seaweed base before drying.
	More effective in terms of capacity and drying process by the local community.	Cannot dry when the weather is rainy and cloudy.
	Minimal dust contamination due to air circulation and its location far from the roadside.	The materials or foundations of the roofs are easily damaged or broken because they are made of wood.
Hanging Drying	It is cheap, because it only uses seaweed ropes and a few poles.	Use large amounts of rope.
	The quality of dried seaweed is better because there is no cutting/breaking of the seaweed base during drying.	It requires extra energy and time to remove the seaweed from the rope.
	The drying process is even and makes it easy to clean seaweed.	
	More effective than the para-para drying method and the mat drying method and is easy to carry out.	

Drying Dome Dryer	The effectiveness of drying is 2x faster than conventional drying methods..	The cost of manufacturing a Dome Dryer is very large compared to other drying methods..
	Prevent contamination	The capacity of the drying area is limited
	Dried materials avoid damage caused by rainy weather.	Requires electricity costs for Blower
		Improper Dome Dryer temperature settings can damage the seaweed because the heat produced is too hot and makes the seaweed too dry and burns.

4.3 Impact Of Drying Methods On The Quality Of Dried Seaweed

In the quality of dried seaweed apart from the drying method there are several factors that influence the quality of dried seaweed, namely; harvest time, post-harvest handling, drying methods and storage methods.

• Seaweed Harvesting Time

Determination of harvest time is an important factor in maintaining the quality of seaweed. The quality of seaweed is not only determined by technical factors in cultivation during the production process, but is also determined by the age of harvest, post-harvest handling methods and weather conditions at harvest.

Eucheuma Cottonii seaweed can be harvested when it is 40-45 days after planting. Harvesting wet products in less than 40 days will produce low quality seaweed because the carrageenan content and gel strength are still low while the water content is still high. This condition is certainly not desired by the seaweed processing industry so that the price of the product is reduced and it is not even purchased at all (Director General of Aquaculture, 2015).

• Seaweed Post-Harvest Handling

Seaweed that has entered the harvest period will be harvested at night to maintain the quality of the seaweed when it is brought to the drying area and lifted onto the para-para in the morning to be cleaned and removed from the ris rope. A good process for releasing seaweed from ris ropes is by directly removing the seaweed clumps from the ris rope ties, or by cutting the base of the stem using a sharp knife to keep the seaweed intact to avoid reducing the quality of the seaweed (Director General of Cultural Fisheries, 2015) .

As explained above, releasing the seaweed and cutting it using a sharp knife can avoid a decrease in quality, however, seaweed cultivators in Tanjung, West Nunukan Sub-district prefer to remove the seaweed from the ropes by shaving or breaking directly at the base of the seaweed. This can indirectly reduce the quality of seaweed because it can cause physical injury to the thallus and be accompanied by the release of

sap/gel from that part, which will cause low dry grass levels (Andriawan Nur Kasrul: 2018).

- Methods for Drying Seaweed

The drying method used by farmers is very important in producing dry seaweed that has good quality. Of the 4 drying methods used by the people of Nunukan Barat Subdistrict based on the effectiveness and efficiency of drying, the Dome dryer is superior to the other 3 drying methods but is considered It is not satisfactory to the local community because it is difficult to determine the desired water content and often makes the seaweed become too dry and burnt, therefore the community prefers to use the para-para drying method which is considered easier to use and has a larger capacity and is suitable for the environment. The people of Tanjung, which is a muddy coastal area, are also used as a bridge to make it easier to move seaweed when the sea water is low.

Then the hanging drying method will be used by the community when the para-para is full and to make it easier to clean the seaweed from dirt. Meanwhile, the drying method with a pedestal is usually used by the community if the seaweed stored in warehouses on land experiences an increase in water content.

Based on the previously written explanation, each drying method has different effectiveness and efficiency according to the needs and costs required. The impact of using each drying method has different impacts on the level of cleanliness, drying speed and drying capacity, however the main factor that influences the drying process is the weather, where if there is bad weather it will hamper the drying process and cause a decrease in drying quality.

4.4 How to Store Seaweed

Seaweed that has been dried, leaving only a water content of around 30%, will be put into sacks for storage in the warehouse. The people of West Nunukan Village use a method called "Sasak" where a 50 kg sack is attached to a round iron frame with a diameter of 45 cm and a height of 100 cm and then the seaweed is put into the sack using a shovel or hand, after which the seaweed will be given pressure by stepping on it so that the seaweed in the sack becomes solid and you can put more seaweed into the sack. Once the sack is deemed to be full enough and can no longer be filled, the top of the sack will be tied tightly using rice needles and raffia rope and then stored inside. warehouse.

The storage process in the warehouse takes approximately 3-5 days, the seaweed is arranged horizontally and stacked in 3-4 piles (depending on the height of the warehouse). During the storage period, farmers usually take the seaweed out of the warehouse to dry in the sun using tarpaulin, this is because based on information from the public, seaweed experiences an increase in water content after being stored in the warehouse for 3-5 days, so it needs to be dried again to reduce the rising water content.

Storing dried seaweed for a certain period of time before distribution or processing can reduce its quality, this is because during storage microbial contamination can occur, increasing the water content due to damp storage areas (Wirawan Gde Adhy: 2013).

Acknowledgment

Based on the results of the research that has been carried out, it can be seen that each seaweed drying method used by the Tanjung community has the following quality results for dried seaweed:

1. There are four generally used methods:

a. The Drying Method with a Pedestal, has poor drying quality results in re-drying dried seaweed from the warehouse because most people dry it on the side of the road, which causes the dried seaweed to easily become contaminated with dirt such as dust.

b. The hanging drying method has very good quality results in terms of weight of seaweed and in terms of hygiene, but is not popular with the public because this method can damage the rope and requires extra time and effort to remove the seaweed from the rope.

c. Metode Pengeringan Para- para, has good quality results but is not as good as the hanging method but is good enough in terms of drying capacity and is the most suitable method for the Tanjung community.

d. Drying Method: Dome dryers have good quality results in terms of hygiene and drying speed but are not used by local communities due to several factors such as difficulty in determining water content, limited capacity and the price is too expensive if built independently.

2. Of the four techniques used, the drying technique on para-para is more effective and is most widely used by seaweed fishermen in Tanjung Harapan.

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